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Light driven directional mass transport of azo-benzene containing materials for complex tri-dimensional structures on surfaces

Stefano L Oscurato[1], **Fabio Borbone**[1], **Pasqualino Maddalena**[1] and **Antonio Ambrosio**[2]
[1]University of Naples Federico II, Italy
[2]Harvard University, Cambridge, USA

Inspired by nature, in the last years the role of the topography of superficial textures in determining surface functionalities is increasingly recognized and the fabrication of controlled tridimensional textures became a demanding point of material science because of the potential applications in many fields as photonics, functional and smart surfaces. Standard fabrication techniques, including photo-lithography, electron beam and focused ion beam lithography, self-assembly, soft lithography, etc., often require multi-step processes in order to realize 3D architectures and the fabricated geometries are rarely further tunable. However, the light-induced mass migration phenomenon arising in photo-responsive azo-benzene containing materials opens to new fabrication approaches. Under illumination, the azo-benzene molecules exhibit photo-isomerization *trans-cis-trans* cycles. This microscopic motion drives a reorganization of the host material, typically a polymer, in which the molecules are embedded, resulting in a macroscopic material displacement. This material motion is highly directional and occurs in the illuminating light polarization direction. Recently, our group proposed phenomenological models to deterministically predict the topography of the azo-surfaces resulting from light-surface interaction in different configurations. So the light-driven mass migration can be actually used to fabricate new classes of surface topographies, which can be even further modified once fabricated. Here, we demonstrate the potentiality of this technique by realizing tri-dimensional complex superficial patterns based either on spatially structured illumination light patterns or on reshaping of pre-patterned surface architectures. Spatially modulated intensity patterns are achieved in a versatile way by phase-modulating a laser beam through a computer controlled spatial light modulator, resulting in topography modulation of the azo-surfaces, even with high spatial resolution (Fig. 1a). On the other side, tri-dimensional architectures are obtained by reshaping pristine pre-patterned micron-posts in simple illumination condition. These resulting structures are proven to produce a change in the wetting behavior of the textured surface with a demonstrated controlled directional droplet spreading (Fig. 1b).

Biography

Stefano L Oscurato has done his MSc in Physics from the University of Naples "Federico II" Italy, and his Master's dissertation was about the development of a holographic scanning microscopy technique. He is doing his Doctoral studies at the University of Naples, supervised by Professor Pasqualino Maddalena and Dr. Antonio Ambrosio. His PhD work is about the use of light-driven mass migration in azobenzene-containing materials for application in photonics, wettability and adhesion.

oscurato@fisica.unina.it

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